

FURTHER INVESTIGATIONS OF THE SPOTTED OWL

(Strix occidentalis)

In Six Rivers National Forest

By

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Introduction

The Northern Spotted Owl (Strix occidentalis caurina) is considered a Sensitive Species by the U.S. Forest Service, Region V, and by Six Rivers National Forest. Concern for the future viability of this species in areas of intensive timber management has been expressed by workers in California and Oregon (Could 1977; Forsman, 1976, 1977; Marcot 1978) because of the species' apparent dependence on mature and old-growth forest.

The distribution of the Northern Spotted Owl in northwestern California is still poorly known. Could (1977) reported a total of 191 northern spotted owls, representing 122 pairs, in California, six pairs of which were on Six Rivers National Forest. Additional surveys or reports of spotted owls in the Six Rivers N. F. area have been given by Hill (1976), Williams (1977) and Erickson (no date). All of the above were one dimensional linear surveys and therefore give little information as to density or ecological distribution. Marcot (1978) conducted intensive localized surveys in Six Rivers N. F. and found 68 spotted owls representing 54 breeding territories suggesting a much higher concentration of Spotted Owls than previously believed.

This study was designed to extend and expand upon Marcot's (1978) data. The objectives were to:

1. survey potential timber sale areas for presence of breeding territories;
2. to test the predictability of the presence of spotted owl territories based on existing knowledge of habitat requirements,
3. to locate and describe nest sites in known spotted owl territories.

A number of people assisted in this study and to all of them I wish to express thanks: Ed Toth and Ronald Escaño provided direction and helpful comments and suggestions; Kurt Nelson, Tom Mull, and Greg Leisten assisted in the field surveys; Kevin Kveton assisted in the mapping of potential habitat and in field surveys; and last but not least to Bruce Marcot for field assistance and invaluable comments and insights throughout the study.

METHODS

Delineation of potential spotted owl territories

Potential spotted owl territories were outlined on 1974 Timber Stand Maps (1:24,000) of the Six Rivers National Forest using the following criteria:

Potential optimal habitat - Polygons or combinations of polygons totaling 300 acres or more, adjacent to (0-600 ft.) permanent water, composed of mature or old growth Douglas Fir or Douglas Fir with pines, white fir, or cedar, and a canopy closure of 60-100% or 40-60% with an understory, were outlined as potential optimal habitat. These criteria in Standard Timber Type (WRIS) classification are D, or D w/ P, WF, or C, 4 or 5 $\bar{=}$, or 4 or 5 $\bar{=}$ /2-5 $\bar{=}$ or $\bar{=}$. These translate to a Wildlife/Habitat relationships (WHR) classification of 4c or 4b/3b or 4b/3c.

Potential suboptimal habitat - Polygons or combinations of polygons totaling 300 acres or more, adjacent (0-1000 ft.) to permanent water, composed of pole-medium sized Douglas Fir or Douglas Fir with pines, white fir or cedar and a canopy closure of 40-60%, or mature to old growth stands with a canopy closure of 40-60% and no understory, were outlined as potential suboptimal habitat. The WRIS codes for suboptimal habitat are D or D w/ P, WF, or C, 3 $\bar{=}$ or $\bar{=}$, or 4 or 5 $\bar{=}$. The WHR codes are 3b, 3c, 4b, or 4c.

Potential marginal habitat - Polygons or combinations of polygons totalling 200 acres or more, adjacent (0-1000 ft.) to permanent water, composed of old growth Douglas Fir with a crown closure of 0-40% and an understory, or mature Douglas Fir with a crown closure of 20-40% and an understory, were outlined as potential marginal habitat. The WRIS codes for marginal habitat are D5- or D4- and better with any understory. The WHR codes are 4a or 4a with any understory.

Field Surveys

The study areas were surveyed in one of three ways, as indicated in Table 1.

1) In the complete survey an effort was made to census the entire timber sale area regardless of habitat composition. The method was the same as that used by Marcot (1978). Forest Service roads through and/or around the area were driven and calling stations established at 0.5 mile intervals. 2) In the more limited designated potential site survey only areas outlined as potential sites were censused. Potential sites to be checked were chosen to meet two criteria: a) located in or near a timber sale area, and b) accessible by 2 or 4-wheel road. Potential sites were surveyed by driving or walking through and/or around the outlined area, stopping at 0.5 mile intervals. 3) Territories located in 1978 were surveyed by returning to the exact station from which a response was solicited in 1978. The original field maps were used to find the calling stations. If there was no response to solicitation from the original station, an effort was made to call from other vantage points to assure adequate coverage of the 1978 territory.

An attempt was made to locate actual nest sites in known territories by daylight calling. The suspected nest area was transected on foot, calling intermittently by tape or voice.

At calling stations in all surveys a response was solicited by playing a pre-recorded cassette tape (Forsman, U.S. Fish and Wildlife Service) on a 1.5 watt output portable cassette tape player or by voice imitation. Approximately 15 minutes were spent at each station, with 2-4 minutes of calling interspersed with 2-4 minutes of silence.

Table 1. The study areas (timber sales) by County, legal location, Six Rivers National Forest Ranger District, vegetation type, date, and type of survey. The study areas are listed roughly as they occur north to south.

TS Name	County	Legal location ^a	SRNF District	Veg. Type ^b	Dates Surveyed	Type of Survey ^c
Winchuck	Del Norte	T18N, R1E, Sec 3, 4, 9 T19N, R1E, Sec 33, 34	Gasquet	21	21 May 29 May	3
Patrick	Del Norte	T18N, R3E, Sec 26, 27, 28. 33, 34, 35 T17N, R3E, Sec 2, 3, 4, 9	Gasquet	21	7 June	2
Jaws	Del Norte	T17N, R3E, Sec 10, 13, 14 15,21,22,23,24,25,26,27 28,33,34,35,36 T17N, R4E, Sec 20, 28, 29 32, 33 T16N, R3E, Sec 2, 3	Gasquet	12/21	20 March 17 April 25 April	3
Camp 7	Del Norte	T16N, R2E, Sec 13,24,25,26	Gasquet	21	5-6 June	3
Gulch	Del Norte	T17N, R1E, Sec 25 T17N, R2E, Sec 31,33,34,35 T16N, R2E, Sec 3,5,6,11	Gasquet	21	14 June	2
Black	Del Norte	T16N, R3E, Sec 33, 34 T15N, R3E, Sec 3,4,8,9 10,15,16,21,22	Gasquet	21	5-6 June	1
Lower	Del Norte	T16N, R2E, Sec 5, 7, 8 14,22,23,27	Gasquet	21	14 June	2
Honker	Del Norte	T14N, R3E, Sec 29, 30, 31 30,31,32,33 T13N, R3E, Sec 4, 5, 6, 7 8,17,18	Gasquet	21	12 May	1

Table 1. cont.

TS Name	County	Legal location ^a	SRNF District	Veg Type ^b	Dates Surveyed	Type Survey ^c
Lick	Del Norte/ Humboldt/ Siskiyou	T12N, R4E, Sec 13, 14, 15 22, 23, 24, 25, 26, 27, 34, 35, 36 T12N, R5E, Sec 30, 31 T11N, R4E, Sec 1, 2, 3, 9 10, 11, 12	Orleans	21	12 May	1
Wilder	Siskiyou/ Humboldt	T12N, R5E, Sec 36 T11N, R5E, Sec 1, 2, 11, 12 13, 14	Orleans	12/21	1 May	1
Wilson	Humboldt	T11N, R6E, Sec 8, 9, 17 18, 19	Orleans	12	1 May	3
Featherfoot	Humboldt	T11N, R4E, Sec 8, 17, 18 19, 20, 29, 30	Orleans	12	12 June	1
Dragon	Humboldt	T11N, R4E, Sec 21, 27, 34 T10N, R4E, Sec 2, 3	Orleans	21	25 April 12 June	3
Lilypad	Humboldt	T11N, R4E, Sec 13, 24, 25, 26 T11N, R5E, Sec 18, 19, 20, 21 28, 29, 30, 31, 32, 33	Orleans	21	2 May	1
Cooper	Humboldt	T10N, R4E, Sec 2, 10, 11 13, 14, 15, 22, 23, 24, 25, 26	Orleans	21/12	24-25 April	1
Cape Horn	Humboldt	T10N, R5E, Sec 2, 3, 4 T11N, R5E, Sec 33, 34, 35	Orleans	21	2-3 May	3
Hop	Humboldt	T10N, R5E, Sec 24, 25, 26 27, 34, 35, 36	Orleans	21	17 May	2

Table 1. cont.

TS Name	County	Legal location ^a	SRNF District	Veg. Type ^b	Dates Surveyed	Type Survey ^c
Road	Humboldt	T8N, R5E, Sec 33,34,35,36 T8N, R6E, Sec 30,31,32,33 34 T7N, R5E, Sec 1,2,3,4 T7N, R6E, Sec 4,5,6	Lower Trinity	21	10 May 18 May 2 June	1
Butte	Humboldt	T7N, R4E, Sec 1,11,12,13,14 15,16,17,20,21,22,23,27,29 34,35 T6N, R4E, Sec 3,4,5,6,7,8,9 10,16,17,18	Lower Trinity	21	18 April 11 June	3
Maple	Humboldt	T7N, R5E, Sec 14,23,24,25	Lower Trinity	21	1 June	3
Prairie	Humboldt	T7N, R6E, Sec 15,16,17,20 21,22,23,24,25,25,26,33,34	Lower Trinity	12	30-31 May	1
China	Humboldt	T6N, R4E, Sec 1,11,12,13,14 T6N, R5E, Sec 4,5,9,16,17,18,19	Lower Trinity	21	4 April	3
Willow	Humboldt	T6N, R4E, Sec 15,21,22	Lower Trinity	21	18 April	3
East	Humboldt	T6N, R4E, Sec 26,27,28,33 34 T5N, R4E, Sec 1,2,3,11	Lower Trinity	21	4 April	3
Guard	Humboldt	T5N, R5E, Sec 7,8,16,17,18 19,20,21	Lower Trinity	12	16 May	1
Buck/ Vine Coptor	Humboldt	T5N, R5E, Sec 19,20,21,28 29,30	Lower Trinity	12	16 May	2

Table 1. cont.

TS Name	County	Legal location ^a	SRNF District	Veg. Type ^b	Dates Surveyed	Type Survey ^c
Hastings/ Skull	Humboldt/ Trinity	T2N, R6E, Sec 31,32,33 T1N, R6E, Sec 4,5,8,9	Mad River	12	3 March 24 April 9 May	3
Brown	Humboldt/ Trinity	T2S, R5E, Sec 22,23,24 25,26,27,34,35,36	Mad River	14	6 June	3
Wildcat	Trinity	T1S, R6E, Sec 21,22,27 28,29 T2S, R6E, Sec 25,36	Mad River	22/14	23 May 6 June	2
Fingal	Humboldt/ Trinity	T2S, R6E, Sec 28,29,30 31,32,33 T3S, R6E, Sec 3,4,5,9	Mad River	14	23-24 May	2
Trout	Trinity	T3S, R12W, Sec 19,20,28 29,30,31,32,33 T4S, R12W, Sec 3,4,5,6,7 8,9,10,15,16	Mad River	22	21-22 May	1

^a Humboldt Base Line Meridian.

^b Kuchler's (1977) vegetation types:

- 12 Klamath montane forest with douglas fir
- 14 Coast Range montane forest
- 20 Oregon oak forest
- 21 Mixed evergreen forest with chinquapin
- 22 Mixed evergreen forest with rhododendron

^c 1 complete survey - all timber types
 2 survey of designated potential sites only
 3 survey of territories located in 1978
 See text-methods section for explanation.

The locations of all responding owls were noted on orthographic maps (scale 1:12,000). The location from which an owl first responded was compared to the Timber Stand Maps of potential sites. The responding owl was judged to be in the potential site if it was located in or within one-quarter mile of the site.

A responding owl was judged territorial (breeding) or non-territorial based on the same criteria as used by Marcot (1978); ie., a breeding pair was recognized if 1) a male and female were both heard exchanging location calls; 2) contact calls were heard; 3) a scolding bark was heard; 4) a single owl giving location calls could not be persuaded with intensive solicitation by taped calls to change location.

RESULTS AND DISCUSSION

Mapping of Potential Territories

A total of 435 potential spotted owl territories, encompassing approximately 194,793 acres, were outlined on 1974 Timber Stand Maps of Six Rivers National Forest. Of these, 2 met the optimal habitat criteria, 164 were suboptimal, and 272 were marginal. The average size of the outlined territories was 448 acres (based on measurements of a random sample of 134 potential territories).

In mapping the potential territories no consideration was given to aspect, slope, presence of suitable nest sites, distance to other suitable habitat, or other factors which may be important to the ecology of the spotted owl. Although some attention was paid to obvious topographic features, large areas of contiguous potential habitat were arbitrarily split into separate potential territories. The timber type maps were often found inadequate in describing understories. Timber harvesting since the Timber Stand maps were made has affected some of the potential sites, but no effort was made to account for this. Despite these limitations the method was effective in predicting spotted owl habitat, as discussed below.

Number of Territories and Individuals

Survey results of the study areas are presented in Table 2. A total of 22 spotted owls were recorded representing 8 territories. On six of the territories both male and female owls were heard. Thus, accounting for the other two territories representing a pair, I deduced a total of 24 owls in the study areas, eight (33%) of which were unpaired based on the criteria used. This is much higher than either Marcot's (1978) findings of four percent unpaired or Forsman's (1976) findings of one percent unpaired. On four of the six territories where two birds were found the female exhibited territorial behavior, the male did not. On one of the six territories, the two birds were heard exchanging location calls and on the other neither male nor female exhibited territorial behavior but was judged a territory based on the close proximity of the two birds (1/4 mile). Results of this year's survey of 1978 territories also indicate that a high proportion of the spotted owl population on Six Rivers NF did not breed this year (see below).

TABLE 2 Survey data of the timber sale (TS) study areas broken down into designated potential marginal (PM), potential suboptimal (PS) and nonsuitable (NS) habitats.

Timber Sale Name	#Spotted Owls recorded (#terr. in parentheses)				# potential sites checked			# calling stations				total # minutes called				area surveyed (acres)			
	PM	PS	NS	TOTAL	PM	PS	TOTAL	PM	PS	NS	TOTAL	PM	PS	NS	TOTAL	PM	PS	NS	TOTAL
Patrick	-	-	-	0	2	1	3	4	6	1	11	60	86	15	161	648	1016	672	2336
Black	2(1)	-	-	2(1)	3	1	4	5	3	5	13	100	60	95	255	1805	212	2153	4170
Bulch/Lower	-	-	-	0	3	1	4	8	3	1	12	117	45	15	177	1171	458	771	2400
Bunker	-	-	-	0	-	-	0	-	-	17	17	-	-	255	255	-	-	4600	4600
Cick	3(2)	-	-	3(2)	3	3	6	6	6	15	27	90	84	234	408	1299	1485	6389	9173
Wilder	-	-	-	0	-	1	1	-	2	5	7	-	28	62	90	-	318	965	1283
Weatherfoot	-	-	-	0	1	-	1	4	-	5	9	56	-	68	124	665	-	1222	1887
Lilypod	-	-	-	0	1	2	3	4	8	11	23	52	104	134	290	287	514	4148	4949
Cooper	-	1(0)	-	1(0)	2	1	3	10	9	14	33	164	182	224	570	1171	500	1671	3342
hop	1(0)	-	-	1(0)	3	1	4	15	2	-	17	195	35	-	230	1035	350	600	1985
Wood	1(0)	2(1)	-	3(1)	3	3	6	5	7	5	17	84	112	84	280	832	1161	2979	4972
Prairie	1(0)	1(0)	-	2(0)	2	3	5	12	13	16	41	164	182	224	570	1470	1252	6008	8730
Wood a	3(1)	2(1)	-	5(2)	2	1	3	5	5	9	19	69	69	117	255	769	410	2716	3695
Wildcat	-	2(1)	-	2(1)	-	2	2	-	5	2	7	-	88	25	113	-	820	554	1374
Pinjal	-	-	-	0	5	2b	7	10	7b	-	17	110	85b	-	195	1500	1050b	600	3150
Trout	3(1)	-	-	3(1)	4	-	4	12	-	19	31	156	-	239	395	1861	-	5612	7473
Totals	14(5)	8(3)	0	22(8)	34	22	56	100	76	125	301	1417	1160	1791	4368	14513	9546	41660	65719

a. Includes nearby potential sites in Duck and Vine Copter Timber Sales

b. Includes one site outlined as potential optimal habitat

Presence of Spotted Owls in Potential Sites

All of the spotted owls located this year were in areas designated as potential habitat (Table 2). A total of 56 sites were surveyed yielding an 'occupancy rate' in potential sites of 14.3% based on number of territories found and 28.6% based on number of territories plus unpaired birds. No significant difference (two-sample t test, $\alpha=0.05$) was found between occupancy in suboptimal vs. marginal sites.

For comparison, Marcot's (1978) data were analyzed in terms of the potential sites (Table 3). I found a total of 78 potential sites included in the 1978 surveys. Fifty-four spotted owls, representing 45 territories and 5 unpaired birds, were located in potential sites - an occupancy rate of 57.7% based on number of territories plus unpaired birds. Again, no significant difference was found between occupancy of suboptimal vs. marginal sites (two-sample t test, $\alpha=0.05$).

Nine territories located in the 1978 surveys did not occur in designated potential sites. Of these, seven were located adjacent to either the National Forest boundary or tracts of private land, and thus surrounding timber types were not mapped. Excluding these, then, all but two (95.7%) of the 1978 territories were located in potential sites.

It thus appears that the distinctions between optimal, suboptimal, and marginal habitat are not appropriate but the criteria taken together are useful in delineating suitable habitat for spotted owls. The number of territories per study area showed a significant correlation with the number of potential sites per study area (Fig. 1; $r=0.390$, $0.05 > P > 0.02$) and with total acreage of suitable habitat (Fig. 2; $r=0.386$, $0.05 > P > 0.02$).

The difference in occupancy rate of potential sites between the two years' surveys is thought to be largely due to differences in responsiveness to calling between the two years.

TABLE 3. Data from 1978 Surveys in Six Rivers National Forest showing no. and area of potential sites surveyed and no. spotted owls found in potential sites. (PM-potential marginal sites; PS-potential sub-optimal sites). Data from Marcot (1978).

Lumber Sale Name	# Sites Checked			Area Surveyed (acres)			# spotted owls recorded		
	PM	PS	Total	PM	PS	Total	PM	PS	Total
Winchuck	2	1	3	855	453	1308	2(2)	3(2)	5(4)
Baker Flat	4	1	5	1440	373	1813	2(1)	-	3(1)
Jaws	7	1	8	2732	321	3053	6(5)	1(1)	7(6)
Butte Copter	3	2	5	1874	666	2540	1(1)	1(1)	2(2)
Camp 7	3	1	4	1463	408	1871	3(3)	1(1)	4(4)
Sugarloaf	1	1	2	281	402	683	-	1(1)	1(1)
Penn Vista	-	2	2	-	1562	1562	-	2(2)	2(2)
Line	1	5	6	895	1815	2710	1(1)	2(2)	3(3)
Wilson	1	2	3	488	890	1378	1(0)	2(1)	3(1)
Dragon/Creek	-	3	-	1485	1485	-	-	4(2)	4(2)
Cape Horn	2	1	3	1073	492	1565	2(2)	2(2)	4(4)
Butte	3	2	5	983	583	1566	2(2)	-	2(2)
Maple	3	4	7	2023	1524	3547	1(1)	1(1)	2(2)
China	2	1	3	882	396	1278	1(1)	2(2)	3(3)
Willow	3	-	3	1828	-	1828	1(1)	-	1(1)
East	3	1	4	1993	320	2313	2(2)	-	2(2)
Spike	1	1	2	727	363	1090	1(1)	-	1(1)
Pilot Ridge	-	2	2	-	1150	1150	-	1(0)	1(0)
Hastings/Skull	2	-	2	912	-	912	1(1)	-	1(1)
Brown	3	1	4	1216	270	1486	4(3)	-	4(3)
Hetren/Shaw	1	1	2	418	390	808	-	-	0(0)
Totals	45	33	78	22083	13863	35946	31(27)	23(18)	54(45)

(# territories in parenthesis)

Figure 1. Number of spotted owl territories as a function of number of designated potential sites in the study areas. Data are from 1978 and 1979 surveys (n = 37).

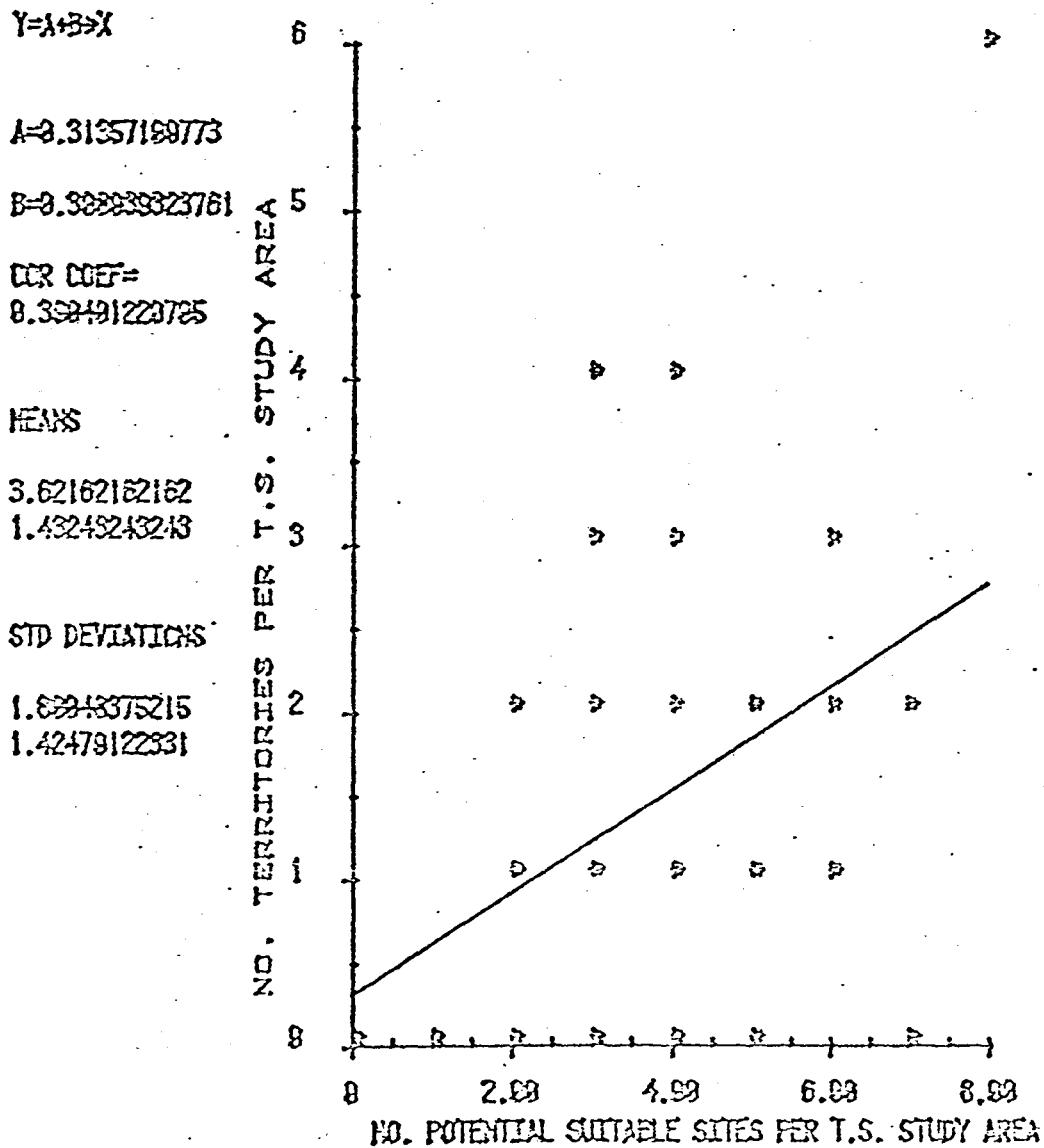
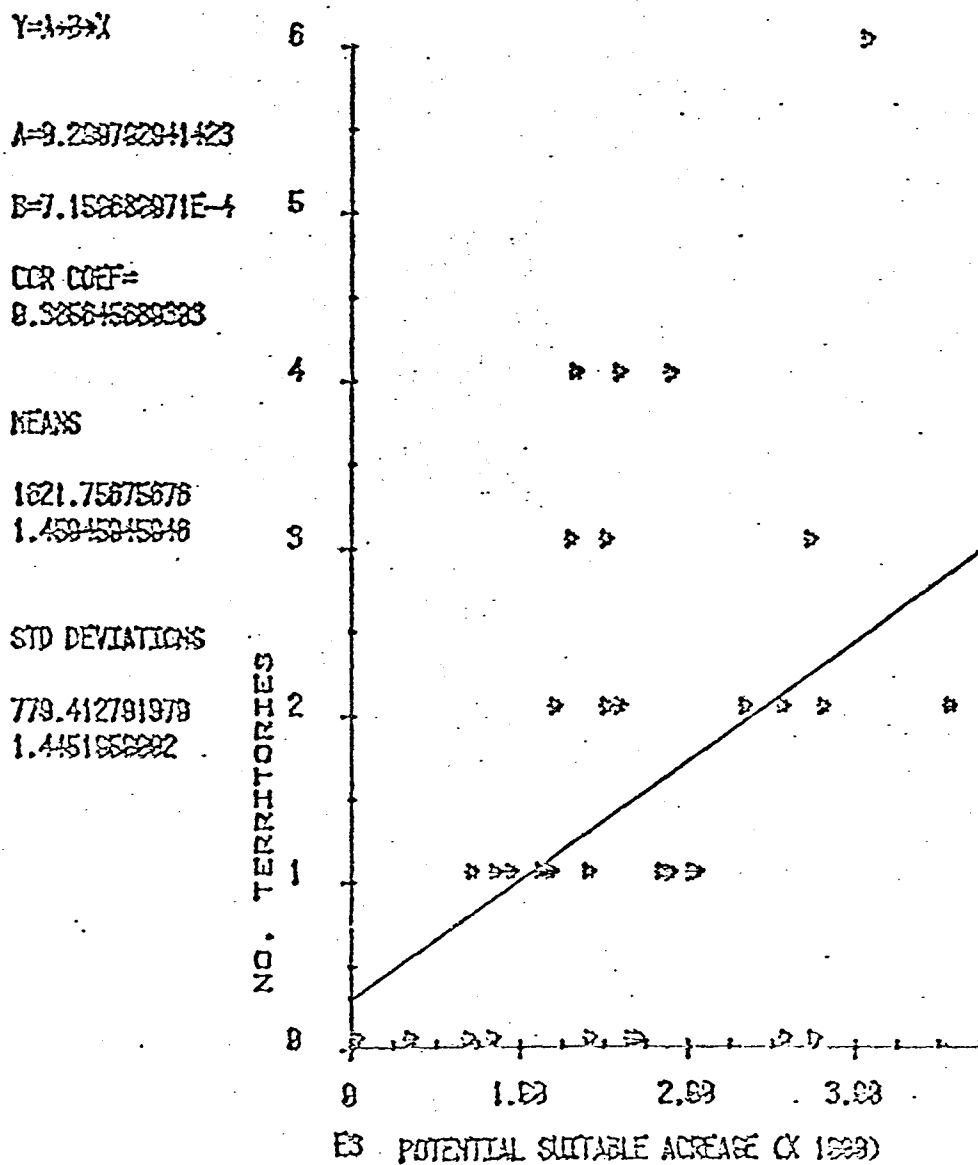


Figure 2. Number of spotted owl territories as a function of total acreage of designated suitable habitat in the study areas. Data are from 1978 and 1979 surveys (n = 37).



Survey of 1978 Territories

Thirty-two of the 54 territories located in 1978 were censused in this study (Table 4). An owl responded on only nine of the 32 territories (28%) and of these only two (22% of the nine territories) showed territorial behavior this year. All nine of the owls responded from within a quarter mile of their 1978 location. Both of the territorial birds and most of the others responded from precisely where they were located in 1978.

Twelve of the territories were checked on more than one night. One territory in Jaws Timber Sale (TS) yielded a response to calling in early April but no response on two subsequent nights of calling in late April and May. Likewise, an owl responded on only one of two nights of calling the same territory in Butte TS, China TS, Fawn TS and one of three nights of calling in Hastings TS. These results suggest that owls were present on the territories but were not strongly defensive of their territory, probably because they were not breeding.

Forsman (1976) reported that the percentage of pairs attempting to nest ranged from 89 percent in 1972, to 16 percent in 1973, and 46 percent in 1974 (n=28, 31, and 37 respectively). Indications from this study and last year's surveys are that a high proportion of the spotted owl population on Six Rivers NF nested last year and there has been a sharp decline in nesting activity this year.

The criteria used for recognizing a bird as a member of a breeding pair may not be sufficient in all cases. Especially the fourth criterion (see Methods Section), regarding being able to induce a bird to change location, was found to be variable. The male of a pair in Black TS whose nest was located and two young found, was easily induced to change location. This pair was located in June. In April, a male was encountered on a 1978 territory in China TS who responded readily to solicitation, but refused to change his location. Thus the willingness to move may vary with the stage of the nesting cycle. Nevertheless, the criteria are the same as used by Marcot and therefore the decline observed this year reflects a true decline in the number of breeding pairs.

Relative Frequency Indices

Relative frequency indices for all study areas are presented in Table 5. A total of 301 calling stations, representing 4368 minutes (72.8 hrs.) of calling along 132 miles of transects, yielded overall relative frequency indices of 0.03 territories per calling station, 0.18 per 100 minutes of calling, and 0.06 per mile transected.

Table 4. Results of nighttime surveys of known spotted owl territories^a

Timber sale name	# terr. surveyed (terr. check-nights ^b in parenthesis)	# terr. which an owl was found (# showing response in paren.)	# calling stations	total min. calling
Winchuc	2(4)	0	4	90
Jaws/Camp 7	4(8)	1(0)	11	245
Wilson	6(6)	0	8	160
Dragon	3(3)	0	4	60
Capehorn	4(4)	1(0)	6	125
Butte	2(4)	1(0)	8	160
Maple	1(1)	1(0)	3	60
China	3(5)	2(1)	4	130
Willow	1(1)	0	4	90
East	1(1)	0	2	115
Hastings	1(3)	1(0)	13	195
Fawn	1(2)	1(0)	9	135
Brown	3(3)	1(1)	8	113
Totals	32(45)	9(2)	84	1678

a. Territories located in 1978 (Marcot 1978).

b. The number of territories checked times the number of nights they were checked.

For example: On Winchuck T.S. the same two territories were called on two different nights for a total of 4 territory check-nights. These territory check-nights are used in calculating a calling responsiveness index (see text).

Table 5. Relative frequency indices of spotted owl territories in the timber sale study areas.

TS Name	No. terr. per station	No. terr. per 100 min.	No. terr. per mile
Patrick	0.0	0	0
Black	0.08	.39	.17
Gulch/Lower	0.0	0	0
Honker	0.0	0	0
Lick	0.07	.49	.16
Wilder	0.0	0	0
Featherfoot	0	0	0
Lilypad	0	0	0
Ccooper	0	0	0
Hop	0	0	0
Road	.06	.36	.13
Prairie	0	0	0
Guard ^a	.11	.78	.22
Wildcat	.14	.88	.33
Fingal	0	0	0
Trout	.03	.25	.07
Totals	.03	.18	.06
Totals corrected for low response rate ^b	.15	.90	.30

a. Includes adjacent potential habitat in Buck and Vine Copter Timber Sales.

b. Index divided by 0.20 response rate. See text for discussion.

These indices are considerably lower than those found in Six Rivers NF by Marcot (0.17 territories per calling station, 0.98 per 100 minutes of calling, and 0.39 per mile transected) (Marcot 1978) or Gould (0.24 territories per mile) (Gould 1974). I believe these low indices are another reflection of reduced breeding activity by spotted owls. It is interesting to note that dividing by a correction factor based on the response of owls in known territories (9 owls responding/45 territory check-nights = 0.20, Table 4) yields indices of 0.15 territories per calling station, 0.90 per 100 minutes calling, and 0.30 per mile transected -- figures very close to those found by Marcot.

I believe the use of a correction factor to account for unresponsiveness of the owls is valid. There were several indications during the surveys that owls were present, could hear the taped calls, but were reluctant to respond. As discussed above, calling the same area on different nights might yield a response one night and none on another. There were also instances where an owl responded with one or two locations calls and then could not be induced to respond again. There were two instances where it was convenient to re-call a station on the same night that a response was solicited earlier in the evening. In both cases no response was obtained on the second visit to the station. It is therefore assumed that a number of owls that were indeed present were not located in the surveys because the owls were not, or only weakly, motivated to respond to calling.

Crude and Ecological Densities.

Table 6 presents crude and ecological densities of spotted owl territories in the timber sale study areas. Again, the overall figures are much lower than those found in 1978 although a few individual study areas are comparable. Once again correcting for the difference in responsiveness (0.20, see above) this year brings the figures into line with last years' results: crude densities of 0.60 territories per 1000 acres this study vs. 0.65 territories per 1000 acres last year; and ecological densities of 1.65 territories per 1000 acres this vs. 1.71 territories per 1000 acres last year.

I believe the uncorrected figures shown in Table 6 are misleading and that the densities derived by correcting for low response rate give a truer estimate of spotted owl density.

It should be noted here that Marcot's ecological density was based on mature and old growth acres only while the suitable habitat criteria used in this study includes dense stands of medium size Douglas Fir (D3⁺ and ⁺).

Table 6. Crude and ecological densities of spotted owl territories in the timber sale study area.

TS Name	<u>Crude Density</u> based on all timber types		<u>Ecological Density</u> based on designated suitable habitat	
	# acres per territory	# territory per 1000 acres	# acres per territory	# territory per 1000 acres
Patrick	-	0	-	0
Black	4170	.24	2017	.50
Gulch/Lower	-	0	-	0
Honker	-	0	-	0
Lick	4587	.22	1392	.72
Wilder	-	0	-	0
Featherfoot	-	0	-	0
Lilypad	-	0	-	0
Cooper	-	0	-	0
Hop	-	0	0	0
Road	4972	.20	1993	.50
Prairie	-	0	-	0
Guard ^a	1948	.51	590	1.70
Wildcat	1374	.73	820	1.22
Fingal	-	0	-	0
Trout	7473	.13	1861	.54
Totals (all areas combined)	8215	.12	3007	.33
(all areas corrected for response rate)	1643	.60	601	1.65

- a. Includes adjacent potential habitat in Buck and Vine Copter Timber Sales.
- b. Density divided by 0.20 response rate. See text for discussion.

The suitable habitat criteria are shown to be more useful than only mature and old growth acreage by the significant correlation between number of territories and acreage of suitable habitat (Fig. 2). A similar correlation run by Marcot between number of territories and mature and old growth acreage was positive but not significant ($r=0.317$, $n=19$, $0.20 > P > 0.10$) (Marcot 1978, Fig. 8). Thus, the ecological densities of the two years' studies are not directly comparable and one should expect estimates based on this study's suitable habitat to be slightly lower, modified by the fact that small tracts of mature and old growth which could not meet the size criteria for suitable habitat would not be included in estimates of ecological density based on suitable habitat.

Population Estimates

In two years of intensive surveys on Six Rivers NF, an inferred total of 137 spotted owls have been located (62 territories + 13 unpaired birds). Assuming the criteria for suitable habitat used in this study is valid, 31% (60,005 of 194,793 acres) of the spotted owl habitat on the forest has been surveyed. Simple extrapolation yields an estimate of 200 pairs plus 42 unpaired individuals on the forest. This does not take into account the low response rate this year.

Estimates based on occupancy rates of potential sites produce similar results. To date, 134 potential sites have been surveyed, 53 (39.6%) were found to contain a territory and 66 (49%) contain either a territory or an unpaired bird. Multiplying these occupancy rates by the number of potential sites (436) yields an estimate of 173 pairs plus 42 unpaired individuals. Again, this estimate is probably low because of the low response rates during this year's surveys.

What I believe to be a more accurate estimate can be obtained by adjusting the occupancy rate of potential sites found in this year's survey to account for the low rate of response, and averaging this corrected figure with the occupancy rate found in the 1978 surveys. Thus the corrected occupancy rate for this year's surveys is 71.5% (14.3% actual occupancy rate/20% response in known territories) and averaging this with last year's rate (57.7% based on territories found) yields a rate of 64.6% of potential sites occupied. Multiplying by number of potential sites (436) gives a total of 282 Spotted Owl territories on Six River NF based on suitable habitat present in 1974.

Locating of Nest Sites

One pair of spotted owls responded in 810 minutes of daylight calling in 7 territories on which an owl was known to be present (based on a response to calling in the territory the previous night) (Table 7). The responding pair was subsequently located visually and two young, estimated to be 20-25 days old on 7 June, were found.

Table 7. Results of daylight calling in known spotted owl territories.^a

TS Name	Territory location	Time Called	Duration	Response
Jaws	T17N R3E Sec 10	0855-1000	65	None
Black	T15N R3E Sec 9	1120-1200	40	male-location calls female-contact whistle 2 young found
Cooper	T10N R4E Sec 24	0800-1000	120	None
Butte	T7N R4E Sec 35	0930-1130	120	None
Gaurd	T5N R5E Sec 21	1300-1345	45	None
China	T6N R5E Sec 18	0800-1200	240	None
Trout	T4S R12W Sec 6	0830-1130	180	None

^a Presented here are only those territories from which a response was elicited on the night previous to daytime calling. An additional 480 minutes were spent daylight calling in 1978 territories which yielded neither a night or daytime response this year.

The male first responded with four-hoot location calls when the observer was less than 80 yards from the nest tree. The female began responding with contact whistles when the observer was less than 20 yards from the nest tree. A description of the nest tree and grove is given in Appendix 2.

The minimal success in finding owls through daytime calling is yet another indication that many pairs of spotted owls were not nesting this year and therefore not responding to calls. Greg Leisten, Biologist on Mad River District, S2NF, observed a pair of spotted owls perched together during the day in Hasting TS. The owls responded to approximately 15 minutes of vocal solicitation by apparently falling asleep.

MANAGEMENT IMPLICATIONS

Calling Responsiveness

The variability in the responsiveness of spotted owls to survey techniques found in this study have important implications for management. Because of time limitations it is usually necessary to make management recommendations for spotted owls in timber sale areas based on one, or at best, a few nights of calling in the area. As suggested by the low rate of response from known territories (20% of known territories responding), many spotted owls may go unnoticed by the procedure and consequently unaccounted for in localized timber harvest plans.

Suitable Habitat

Results of this study indicate that potential spotted owl habitat can be predicted based only on timber type and proximity to water. Over ninetyfive percent of all territories found to date on the Six Rivers NF are located in areas outlined as potential habitat. The lack of territories outside of these potential areas suggests the criteria used in outlining the sites contain some critical elements of the habitat of the northern spotted owl.

Other investigators have reported that the spotted owl nests primarily within dense, old growth stands of Douglas fir (D4 and D5) (Forsman 1976, 1977; Gould 1977). The suitable habitat criteria used in this study also included younger age stands (D3) with greater than 40% canopy cover. All occupied potential sites contained some mature or old growth (D4 or D5), but most sites found occupied had a mixture of small polygons representing different age classes, canopy closures, and understories. This suggests that mature and old growth may indeed be critical habitat for the nest site, but a mixture of stand types may provide suitable foraging habitat. The owls do not appear to be selecting for large homogeneous tracts of mature and old growth in proportion to what is available. As indicated by Marcot (1978) after Jackman and Scott, structural diversity (snags, umbrella crowns, mistletoe, deadfalls, natural cavities, and variety in dbh and height categories and canopy closures) appears to be a key factor in providing suitable habitat for spotted owls.

Size and Spacing of Suitable Habitat

The average size of mapped potential sites on which owls were found was approximately 400 acres; the smallest occupied site was 250 acres. This may or may not indicate a critical minimum area because large areas of suitable habitat were rather arbitrarily split into separate potential territories (sites).

Territories were found on adjacent potential sites of 419 acres and 250 acres (the smallest occupied site). Marcot suggests a minimum critical area of 200-300 acres of mature and old growth forest but notes that minimum critical area will likely vary with quality (presence of key elements) of habitat.

All potential sites which contained a territory were adjacent to or very near (within 1/4 mile) other potential sites. The most isolated territory was found in one of two adjacent potential sites totalling 893 acres. These sites were separated from the next nearest potential site by 1 mile (one section) of unmapped private land. There are few isolated patches of suitable habitat outlined and even fewer surveyed so it is not known if owls are located in isolated patches of suitable habitat. As discussed by Marcot, immigration and emigration 'corridors' of suitable habitat between sites is likely to be very important for dispersal of young.

SUMMARY

Four-hundred thirty-six potential spotted owl territories were outlined on 1974 Timber Stand Maps of Six Rivers National Forest based on timber type, age class, canopy closure, and distance to water. Potential territories were designated as optimal, suboptimal, or marginal. The average size of the outlined territories was 448 acres and the total area outlined was approximately 194,793 acres.

Surveys were conducted in 19 timber sale areas encompassing a total of 65,719 acres which include 24,059 acres of suitable habitat representing 56 potential territories. Twenty-two spotted owls were discovered, representing 3 breeding pairs and 8 unpaired individuals. All owls discovered were located in areas designated as potential territories. Distinctions between potential optimal vs. suboptimal vs. marginal were found to be ineffective.

Thirty-two breeding territories located in 1978 were surveyed this year. An owl was found on 9 of these territories (28.1%) and only two of the nine showed evidence of breeding activity. One nest site was located through daylight calling.

A total of 301 calling stations, representing 4368 minutes (72.8 hrs) of calling along 132 miles of transects, yielded overall relative frequency indices of 0.03 territories per calling station, 0.18 per 100 min. of calling, and 0.06 per mile transected. Overall crude density in all study areas was 0.12 territories per 1000 acres and ecological density was 0.33 territories per 1000 acres of suitable habitat. Evidence is discussed suggesting responsiveness of the owls to vocal solicitation was low due to reduced breeding activity and this biased the survey results. It is suggested that use of a correction factor based on the response of owls in known territories is appropriate and yields more accurate and meaningful frequency indices and density estimates.

Data from surveys for spotted owls in Six Rivers NF conducted in 1978 by Bruce Marcot were reviewed and it was found that 35,946 acres of suitable habitat representing 78 potential territories were included in his surveys. Forty-five (95.7%) of the spotted owl territories discovered in 1978 were located in areas outlined as potential.

A forest-wide population estimate of 282 pairs of spotted owls is derived based on the occupancy rate of potential territories found in two years of intensive surveys.

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APPENDIX I

No. of individuals and territories of all owl species encountered during surveys.

Study Area	Spotted		Flamm		Saw Whet		Screech		GHO	
	Indiv.	Terr.	Indiv.	Terr.	Indiv.	Terr.	Indiv.	Terr.	Indiv.	Terr.
Cooper	1	0							2	2
Wilder										
Lilypad			1	1	2	2			2	1
Road	3	1			2	1				
Gaurd/Mosq.	5	2	1	1						
Hop	1	0								
Trout	3	1	8	8	1	1			1	1
Wildcat	2	1	2	2			3	2		
Bear Sprigs/Fingal										
Prairie	2	0			3	2	3	2		
Black	2	1								
Patrick										
Flat Cant										
Featherfoot										
Lick	3	2							1	1
Gulch/Lower										
Totals	22	8	12	12	8	6	6	4	6	5

APPENDIX II

Description of Spotted Owl Nest Site Located 7 July 1979.

Observer: Kurt Nelson

Legal location: T15N R3E Sec 9 SW 1/4

1974 Timber Type Classification: D5=/D3= with TOM2= adjacent (upslope).

Aspect: South (180°)

Slope: 90 percent

Elevation: 1500 ft.

Description of nest tree: Decadent Douglas Fir; 36+ inches dbh with broken top approx. 125 ft. above ground. Five feet of soft wood extension at broken top with dbh of 32 inches. A leader extension of the live tree extends 35 feet or more above soft top creating canopy of 60% above soft top.

Description of nest grove: Mixed Evergreen forest with Chinquapin (Küchler 1977). Timber type classification accurate as given above; total canopy closure from ground 60-80%. Nest tree located near edge of two timber types approximately 200 ft. from perennial tributary of Jones Creek.